## CLAIMS

1	1.	An integrated photoacoustic spectroscopy cell, comprising:	
2	a mult	ti-layer structure having an inner layer disposed between top and bottom	
3	outer layers, v	with the inner layer being patterned to form a resonant cavity; and	
4	a thin-	film, membrane microphone formed on one of the outer layers and	
5	acoustically coupled to the resonant cavity.		
6			
1	2.	The integrated photoacoustic spectroscopy cell according to claim 1,	
2	wherein the re	esonant cavity is an open-tube resonant cavity to receive light from a source	
1	3.	The integrated photoacoustic spectroscopy cell according to claim 1,	
2	wherein at least the inner layer is patterned to include buffer cavities on either side of the		
3	resonant cavity.		
1	4.	The integrated photoacoustic spectroscopy cell according to claim 3,	
2	wherein one o	or both of the top and bottom outer layers are patterned to include buffer	
3	cavities aligned with the buffer cavities in the inner layer on either side of the resonant		
4	cavity.		
1	5.	The integrated photoacoustic spectroscopy cell according to claim 3,	
2	further including gas inlet and outlet ports through one or both of the outer layers and interest of the outer layers are also outer layers.		
3	the buffer cavities.		

1	6.	The integrated photoacoustic spectroscopy cell according to claim 1,	
2	wherein the th	hin-film microphone is a piezoelectric microphone.	
1 .	7.	The integrated photoacoustic spectroscopy cell according to claim 1,	
2	wherein the microphone is acoustically coupled to the resonant cavity through an acoustic		
3	port in communication with the resonant cavity.		
1	8.	The integrated photoacoustic spectroscopy cell according to claim 1,	
2	wherein the layers are silicon wafers.		
1 -	9.	An integrated photoacoustic spectroscopy cell, comprising:	
2	a struc	cture including an inner layer sandwiched between top and bottom outer	
3	layers;		
4	the in	ner layer being patterned to include an open-tube resonant cavity and buffer	
5	cavities on either side thereof;		
6	one or	both of the top and bottom outer layers being patterned to include a portion	
7	of the buffer cavities on either side of the resonant cavity; and		
8	a piez	oelectric thin-film sensor formed on one of the outer layers and a port	
9	acoustically coupling the sensor to the resonant cavity.		
1	10.	The integrated photoacoustic spectroscopy cell according to claim 9,	
2	including gas inlet and outlet ports formed through one or both of the outer layers and		
3	into the buffer cavities.		

1	11. The integrated photoacoustic spectroscopy cell according to claim 9,		
2	wherein the layers are silicon wafers.		
1	12. A method of fabricating a photoacoustic spectroscopy cell, comprising the		
2	steps of:		
3	forming a resonant cavity in an inner substrate;		
4	joining the inner substrate to a pair of outer substrates, thereby encapsulating the		
5	resonant cavity; and		
6	acoustically coupling a microphone to the resonant cavity.		
1	13. The method of claim 12, further including the step of forming buffer		
2	cavities in the inner substrate on either side of the resonant cavity.		
1	14. The method of claim 13, further including the step of forming buffer		
2	cavities in one or both of the outer layers in alignment with the buffer cavities formed in		
3	the inner substrate.		
1	15. The method of claim 13, further including the step of forming gas inlet		
2	and outlet ports through one or both of the outer layers and into the buffer cavities.		
1	16. The method of claim 12, wherein the step of acoustically coupling a		
2	microphone to the resonant cavity includes the steps of:		

3	depositing a piezoelectric thin film onto one of the outer substrates;		
4	patterning the thin film to create an acoustic sensor; and		
5	forming a port from the acoustic sensor into the resonant cavity.		
1	17. The method of claim 16, wherein the piezoelectric thin film is lead		
2	zirconate titanate (PZT).		
1	18. The method of claim 16, wherein the piezoelectric thin film is alumin	um	
2	nitride (AlN).		
1	19. The method of claim 16, wherein the piezoelectric thin film is zinc or	kide	
2	(ZnO).		
1	20. The method of claim 16, wherein the substrates are silicon substrates.		
1	21. The method of claim 19, wherein the step of joining the inner substra	te to	
2	a pair of outer substrates includes the use of temperature and pressure to create a		
3	gold-silicon eutectic bond.		

- 1 22. The method of claim 19, wherein the step of joining the inner
- 2 substrate to a pair of outer substrates includes the use of temperature and pressure
- 3 to create a gold-tin eutectic bond.